

WHAT IS CLAIMED IS:

1. An image processing apparatus for performing error diffusion processing on multivalued image data having plural density components and outputting the result of
5 said error diffusion processing, comprising:
 - first determination means for, upon execution of said error diffusion processing on a first density component among said plural density components, determining a threshold value used in said error
 - 10 diffusion processing based on a density value of a second density component;
 - first error diffusion execution means for executing said error diffusion processing on said first density component based on the threshold value
 - 15 determined by said first determination means;
 - first output means for outputting the result of execution of said error diffusion processing by said first error diffusion execution means;
 - second determination means for, upon execution of
20 said error diffusion processing on said second density component among said plural density components, determining a threshold value used in said error diffusion processing based on a density value of said first density component;
 - 25 second error diffusion execution means for performing said error diffusion processing on said second density component based on the threshold value

determined by said second determination means; and
second output means for outputting the result of
execution of said error diffusion processing by said
second error diffusion execution means.

5

2. The apparatus according to claim 1, wherein said
first and second determination means use a table showing
a relation between density and threshold values, for
determining the threshold values.

10

3. The apparatus according to claim 1, wherein said
first and second determination means respectively
determine plural threshold values.

15

4. The apparatus according to claim 3, wherein said
first and second determination means respectively use
plural tables for determining said plural threshold
values.

20

5. The apparatus according to claim 1, further
comprising:

third determination means for, upon execution of
said error diffusion processing on a third density
component among said plural density components,

25 determining a threshold value used in said error
diffusion processing based on the sum of the density
values of said first and second density components;

third error diffusion execution means for executing said error diffusion processing on said third density component based on the threshold value determined by said third determination means; and

5 third output means for outputting the result of execution of said error diffusion processing by said third error diffusion execution means.

6. The apparatus according to claim 5, wherein, in a
10 case where said error diffusion processing is performed on said first to third density components,

 said first determination means determines the threshold value used in said error diffusion processing on said first density component, based on the sum of the
15 density value of said second density component and a density value of said third density component,

 and said second determination means determines the threshold value used in said error diffusion processing on said second density component, based on the sum of
20 the density value of said first density component and the density value of said third density component.

7. The apparatus according to claim 1, wherein said plural density components are a yellow component, a
25 magenta component, a cyan component and a black component,

 and said first density component is the cyan

component, said second density component is the magenta component, and said third density component is the black component.

5 8. The apparatus according to claim 5, further comprising image formation means for inputting the results of execution of said error diffusion processing outputted from said first to third output means and performing image formation.

10

9. The apparatus according to claim 8, wherein said image formation means is an ink-jet printer.

10. The apparatus according to claim 9, wherein said
15 ink-jet printer has an ink-jet printhead that discharges ink by utilizing thermal energy,
and wherein said ink-jet printhead has electrothermal transducers for generating the thermal energy to be supplied to the ink.

20

11. An image processing method for performing error diffusion processing on multivalued image data having plural density components and outputting the result of said error diffusion processing, comprising:

25 a first determination step of, upon execution of said error diffusion processing on a first density component among said plural density components,

determining a threshold value used in said error diffusion processing based on a density value of a second density component;

- a first error diffusion execution step of
- 5 executing said error diffusion processing on said first density component based on the threshold value determined at said first determination step;

 a first output step of outputting the result of execution of said error diffusion processing at said

- 10 first error diffusion execution step;

 a second determination step of, upon execution of said error diffusion processing on said second density component among said plural density components, determining a threshold value used in said error

- 15 diffusion processing based on a density value of said first density component;

 a second error diffusion execution step of performing said error diffusion processing on said second density component based on the threshold value

- 20 determined at said second determination step; and

 a second output step of outputting the result of execution of said error diffusion processing at said second error diffusion execution step.

- 25 12. The method according to claim 11, wherein at said first and second determination steps, a table showing a relation between density and threshold values is used

for determining the threshold values.

13. The method according to claim 11, wherein at said
first and second determination steps plural threshold
5 values are respectively determined.

14. The method according to claim 13, wherein at said
first and second determination steps, plural tables are
respectively used for determining said plural threshold
10 values.

15. The method according to claim 11, further
comprising:

a third determination step of, upon execution of
15 said error diffusion processing on a third density
component among said plural density components,
determining a threshold value used in said error
diffusion processing based on the sum of the density
values of said first and second density components;

20 a third error diffusion execution step of
executing said error diffusion processing on said third
density component based on the threshold value
determined at said third determination step; and

25 a third output step of outputting the result of
execution of said error diffusion processing at said
third error diffusion execution step.

16. The method according to claim 11, wherein, in a case where said error diffusion processing is performed on said first to third density components,

at said first determination step, the threshold
5 value used in said error diffusion processing on said first density component is determined, based on the sum of the density value of said second density component and a density value of said third density component,

and at said second determination step, the
10 threshold value used in said error diffusion processing on said second density component is determined, based on the sum of the density value of said first density component and the density value of said third density component.

15

17. A computer readable memory for storing a program for executing the image processing method according to any one of claims 11 to 16.

20 18. An image processing apparatus for performing error diffusion processing on multivalued image data having plural density components and outputting a result of said error diffusion processing, comprising:

calculation means for calculating a sum and
25 difference between density values of a first density component and a second density component among said plural density components;

M-ary conversion means for converting a value of the sum into M-ary code by using a first function based on the sum;

N-ary conversion means for converting a value of
5 the difference into N-ary code by using a second function based on the difference; and

execution means for executing multivalue error diffusion processing respectively on said first and second density components, based on the result of
10 conversion by said M-ary conversion means and the result of conversion by said N-ary conversion means.

19. The apparatus according to claim 18, wherein M and N are respectively a positive integer equal to or greater
15 than 3.

20. The apparatus according to claim 18, wherein said first function used in said M-ary conversion means is represented in a first table showing a relation between
20 the value of the sum and an M-ary code,

and wherein said second function used in said N-ary conversion means is represented in a second table showing a relation between the value of the difference and an N-ary code.

25

21. The apparatus according to claim 18, wherein said multivalue error diffusion processing is executed by

said execution means by using a two-dimensional table with the result of the conversion by said M-ary conversion means and the result of the conversion by said N-ary conversion means as functions.

5

22. The apparatus according to claim 21, wherein said two-dimensional table is a common table for said first and second density components.

10 23. The apparatus according to claim 21, wherein said two-dimensional table is prepared respectively for said first and second density components.

15 24. The apparatus according to claim 18, wherein said plural density components are a yellow component, a magenta component, a cyan component and a black component,

20 and wherein said first density component is the cyan component, and said second density component is the magenta component.

25. The apparatus according to claim 18, further comprising image formation means for inputting the result of execution of said error diffusion processing and performing image formation.

26. The apparatus according to claim 25, wherein said

image formation means is an ink-jet printer.

27. The apparatus according to claim 26, wherein said
ink-jet printer has an ink-jet printhead that discharges
5 ink by utilizing thermal energy,

and wherein said ink-jet printhead has
electrothermal transducers for generating the thermal
energy to be supplied to the ink.

10 28. An image processing method for performing error
diffusion processing on multivalued image data having
plural density components and outputting a result of
said error diffusion processing, comprising:

15 a calculation step of calculating a sum and
difference between density values of a first density
component and a second density component among said
plural density components;

20 an M-ary conversion step of converting a value of
the sum into M-ary code by using a first function based
on the sum;

an N-ary conversion step of converting a value of
the difference into N-ary code by using a second
function based on the difference; and

25 an execution step of executing multivalue error
diffusion processing respectively on said first and
second density components, based on the result of
conversion at said M-ary conversion step and the result

of conversion at said N-ary conversion step.

29. The method according to claim 28, wherein M and N
are respectively a positive integer equal to or greater
5 than 3.

30. The method according to claim 28, wherein said first
function used at said M-ary conversion step is
represented in a first table showing a relation between
10 the sum value and an M-ary code,

and wherein said second function used at said N-
ary conversion step is represented in a second table
showing a relation between the difference value and an
N-ary code.

15

31. The method according to claim 28, wherein said
multivalue error diffusion processing is executed at
said execution step by using a two-dimensional table
with the result of the conversion at said M-ary
20 conversion step and the result of the conversion at said
N-ary conversion step as functions.

32. The method according to claim 28, wherein said
plural density components are a yellow component, a
25 magenta component, a cyan component and a black
component,

and wherein said first density component is the

cyan component, and said second density component is the magenta component.

33. A computer readable memory for storing a program for
5 executing the image processing method according to any
one of claims 28 to 32.

34. An image processing apparatus for performing error diffusion processing on multivalued image data having
10 plural density components and outputting a result of said error diffusion processing, comprising:

analysis means for examining density values of a first density component and a second density component among said plural density components; and

15 control means for exclusively or independently outputting the result of said error diffusion processing on said first density component and that of said error diffusion processing on said second density component, in accordance with a result of analysis by said analysis means,

20 wherein if at least one of said first and second density components has an intermediate density value, said control means independently outputs the results of said error diffusion processing, while if said first and
25 second density components do not have an intermediate density value, exclusively outputs the results of said error diffusion processing.

35. The apparatus according to claim 34, wherein said analysis means includes:

first comparison means for comparing a sum of the
5 density values of said first and second density components among said plural density components with a predetermined threshold value; and

10 second comparison means for comparing the density value of said first density component and the density value of said second density component with each other,

15 wherein said control means performs printing by said error diffusion processing based on said first density component or said second density component, based on results of comparison by said first and second comparison means.

36. The apparatus according to claim 35, further comprising third comparison means for comparing the density value of said first density component with said 20 predetermined threshold value,

wherein said control means further determines whether or not printing by said error diffusion processing is to be performed not only based on said first density component, but also based on the result of 25 comparison by said third comparison means.

37. The apparatus according to claim 35, further

comprising fourth comparison means for comparing the density value of said second density component with said predetermined threshold value,

wherein said control means further determines

5 whether or not printing by said error diffusion processing is to be performed not only based on said second density component, but also based on the result of comparison by said fourth comparison means.

10 38. The apparatus according to claim 34, wherein said plural density components are a yellow component, a magenta component, a cyan component and a black component,

and wherein said first density component is the
15 cyan component, and said second density component is the magenta component.

39. The apparatus according to claim 34, wherein said plural density components of said multivalued image data
20 are respectively binarized by said error diffusion processing.

40. The apparatus according to claim 34, wherein said plural density components of said multivalued image data
25 are respectively converted by said error diffusion processing into N-ary codes.

41. The apparatus according to claim 40, wherein said N is a positive integer equal to or greater than 3.

42. The apparatus according to claim 40, further
5 comprising a table showing a relation between a density value and an N-ary code output value, for N-ary conversion.

43. The apparatus according to claim 42, wherein said
10 table is a common table for said first and second density components.

44. The apparatus according to claim 42, wherein said table is prepared respectively for said first and second
15 density components.

45. The apparatus according to claim 34, further comprising image formation means for inputting a result of execution of said error diffusion processing and
20 performing image formation.

46. The apparatus according to claim 45, wherein said image formation means is an ink-jet printer.

25 47. The apparatus according to claim 46, wherein said ink-jet printer has an ink-jet printhead that discharges ink by utilizing thermal energy,

and wherein said ink-jet printhead has electrothermal transducers for generating the thermal energy to be supplied to the ink.

5 48. The apparatus according to claim 34, wherein said intermediate density is higher than an approximately half level of a maximum density level.

10 49. An image processing method for performing error diffusion processing on multivalued image data having plural density components and outputting a result of said error diffusion processing, comprising:

15 an analysis step of examining density values of a first density component and a second density component among said plural density components; and
20 a control step of exclusively or independently outputting the result of said error diffusion processing on said first density component and that of said error diffusion processing on said second density component, in accordance with a result of analysis at said analysis step,

25 wherein at said control step, if at least one of said first and second density components has an intermediate density value, the results of said error diffusion processing are independently outputted, while if said first and second density components do not have an intermediate density value, the results of said error

diffusion processing are exclusively outputted.

50. The method according to claim 49 wherein said analysis step includes:

5 a first comparison step of comparing a sum of the density values of said first and second density components among said plural density components with a predetermined threshold value; and

10 a second comparison step of comparing the density value of said first density component and the density value of said second density component with each other,

15 wherein at said control step, printing is performed by said error diffusion processing based on said first density component or said second density component, based on results of comparison at said first and second comparison steps.

51. The method according to claim 50, further comprising a third comparison step of comparing the density value 20 of said first density component with said predetermined threshold value,

25 wherein at said control step, it is further determined whether or not printing by said error diffusion processing is to be performed not only based on said first density component, but also based on result of comparison at said third comparison step.

52. The apparatus according to claim 50, further comprising a fourth comparison step of comparing the density value of said second density component with said predetermined threshold value,

5 wherein at said control step, it is further determined whether or not printing by said error diffusion processing is to be performed not only based on said second density component, but also based on result of comparison at said fourth comparison step.

10

53. The method according to claim 49, wherein said plural density components are a yellow component, a magenta component, a cyan component and a black component,

15 and wherein said first density component is the cyan component, and said second density component is the magenta component.

20 54. The method according to claim 49, wherein said plural density components of said multivalued image data are respectively binarized by said error diffusion processing.

25 55. The method according to claim 49, wherein said plural density components of said multivalued image data are respectively converted by said error diffusion processing into N-ary codes.

56. The method according to claim 55, wherein said N is
a positive integer equal to or greater than 3.

5 57. The method according to claim 49, wherein said
intermediate density is higher than an approximately
half level of a maximum density level.

10 58. A computer readable memory for storing a program for
executing the image processing method according to any
one of claims 49 to 57.

PCT/GB2007/002512